

What is claimed is:

1. An electric battery having a plurality of aqueous electrolyte cells, said battery being connectable to a fluid source for replenishing fluid in said cells, said battery comprising:

a fluid conduit fixed to said battery and capable of being connected in fluid communication with said fluid source, said fluid conduit being in fluid communication with said cells;

a valve system operatively associated with said fluid conduit for controlling fluid flow from said fluid source, through said fluid conduit and to said cells;

an electrolyte level sensor capable of generating signals indicative of an amount of electrolyte in at least one of said cells; and

a controller attached to said battery and in communication with said electrolyte level sensor and said valve system, said controller controlling said valve system to allow fluid to flow to said cells in response to signals from said level sensor indicative of a deficient amount of electrolyte in said cells, and preventing fluid flow to said cells in response to signals from said level sensor indicative of a sufficient amount of electrolyte in said cells.

2. An electric battery according to Claim 1, wherein said valve system comprises:

a conduit valve positioned in said fluid conduit to control fluid flow from said fluid source to said cells, said conduit valve being in communication with and under the control of said controller for opening and closing thereof;

a plurality of cell valves, one of said cell valves being positioned in each of said cells for controlling fluid flow from said fluid conduit to each of said cells.

3. An electric battery according to Claim 2, wherein each of said cell valves comprises a valve member responsive to a level of fluid in each said cell to effect opening of said cell valve when said amount of fluid is less than a first

predetermined amount, and closing of said cell valve when said amount of fluid is greater than a second predetermined amount.

5      4. An electric battery according to Claim 2, wherein said controller comprises a microprocessor.

5. An electric battery according to Claim 4, wherein said conduit valve is electrically openable and closable by said microprocessor.

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6. An electric battery according to Claim 1, wherein said fluid source has a fitting connectable to said fluid conduit through a coupling attached to said battery, said coupling comprising:

15                    a biasing member positioned between said coupling and said fitting for ejecting said fitting away from and out of engagement with said coupling; and

                    a latch movable between a first position engaging and holding said fitting in engagement with said coupling against said biasing member, and a second position releasing said fitting from engagement with said coupling, said latch being actuated between said first and second positions by said controller.

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7. An electric battery according to Claim 6, wherein said latch is electrically actuatable between said positions.

25      8. An electric battery according to Claim 6, wherein said latch comprises a sensor adapted to generate signals indicative of engagement and disengagement of said fitting with said coupling, said sensor being in communication with said controller.

9. An electric battery according to Claim 1, further comprising a ventilated cover positioned on said battery over said controller and said valve system.

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10. An electric battery according to Claim 9, wherein said cover is locked to said battery thereby restricting access to said controller and said valve system.

11. An electric battery according to Claim 1, further including:

5                   a charging sensor capable of generating a signal indicating when said battery is being charged, said charging sensor being in communication with said controller; and

                  an air pump in fluid communication with said cells, said air pump being in communication with and controlled by said controller and pumping air into said  
10       cells to promote mixing of said fluid therein and thereby prevent acid stratification during charging.

12. An electric battery according to Claim 11, wherein said charging sensor comprises a Hall Effect device mounted on said battery for measuring flow of  
15       electrical current to said battery indicative of charging.

13. An electric battery according to Claim 11, wherein said charging sensor comprises an electrical shunt device mounted on said battery for measuring flow of  
20       electrical current to said battery indicative of charging.

14. An electric battery according to Claim 11, further comprising an air conduit fixed to said battery and extending to each of said cells, said air conduit providing fluid communication between said air pump and said cells.

25       15. An electric battery according to Claim 11, further comprising a ventilated cover positioned on said battery over said controller, said valve system and said air pump.

16. An electric battery according to Claim 15, wherein said cover is locked to said battery thereby restricting access to said controller, said valve system and said air  
30       pump.

17. An electric battery having a plurality of aqueous electrolyte cells, said battery comprising:

an air pump fixed to said battery;

an air conduit fixed to said battery and in fluid communication with said air pump, said air conduit extending to each of said cells and providing fluid communication between said air pump and said cells;

a charging sensor attached to said battery and capable of generating signals indicating when said battery is being charged; and

a controller in communication with said charging sensor and said air pump, said controller activating said air pump in response to said signals from said charging sensor indicating that said battery is being charged, said air pump pumping air into said cells to promote mixing of said electrolyte and thereby prevent acid stratification during charging.

18. An electric battery according to Claim 17, further comprising a plurality of air pumps in fluid communication with said air conduit, said controller being in communication with said air pumps and activating said air pumps upon charging of said battery, said air pumps pumping air into said cells to promote mixing of said electrolyte and thereby prevent acid stratification during charging.

19. An electric battery according to Claim 18, wherein said controller includes:

a pump sensor capable of generating a signal indicating failure of any of said pumps; and

an alarm in communication with said controller, said alarm being responsive to said pump sensor signal and adapted to generate an alarm signal indicative of said failure.

20. An electric battery according to Claim 17, further comprising a ventilated cover positioned on said battery over said controller and said air pump.

21. An electric battery according to Claim 17, wherein said charging sensor comprises a Hall Effect device mounted on said battery for measuring flow of electrical current to said battery indicative of charging.

5        22. An electric battery according to Claim 17, wherein said charging sensor comprises an electrical shunt device mounted on said battery for measuring flow of electrical current to said battery indicative of charging.

10        23. An electric battery having an aqueous electrolyte, said battery comprising:  
                 a plurality of first cells holding said electrolyte;  
                 a first air pump;  
                 a first air conduit in fluid communication with said first air pump and  
extending to said first cells to provide fluid communication between said first air  
conduit and each of said first cells;  
15        a plurality of second cells holding said electrolyte;  
                 a second air pump;  
                 a second air conduit in fluid communication with said second air pump  
and extending to said second cells to provide fluid communication between said  
second air conduit and each of said second cells;  
20        a sensor capable of generating signals indicating when said battery is  
being charged; and  
                 a controller in communication with said sensor and said first and  
second air pumps, said controller activating said air pumps in response to said  
signals from said sensor indicating that said battery is being charged, said air pump  
25        pumping air into said first and second cells to promote mixing of said electrolyte and  
thereby prevent acid stratification during charging.

24. An electric battery according to Claim 23, further comprising a bridge conduit  
providing fluid communication between said first and said second air conduits, said

bridge conduit allowing one of said first and second pumps to pump air into both of said first and said second cells during charging of said battery.

25. An electric battery according to Claim 23, wherein said controller includes:

5                   a pump sensor capable of generating a signal indicating failure of any of said pumps; and

                  an alarm in communication with said controller, said alarm being responsive to said pump sensor signal and adapted to generate an alarm signal indicative of said failure.

10           26. An electric battery according to Claim 23, further comprising a ventilated cover positioned on said battery over said controller and said air pumps.

15           27. A method of mixing electrolyte in cells of an electric battery having a liquid electrolyte to prevent stratification, said method comprising the steps of:

                  sensing when said battery is being charged; and  
                  pumping air into said electrolyte within said cells during charging using an air pump mounted on said battery in fluid communication with said cells through a conduit fixed to said battery.

20           28. A method according to Claim 27, wherein said pumping step is effected using a plurality of air pumps.

29. A method according to Claim 28, further comprising the steps of:

25                   sensing if one of said air pumps fails to operate; and  
                  compensating for a failure of one of said air pumps using other of said air pumps.

30. A method according to Claim 29, wherein said compensating step comprises increasing a rate at which said other air pumps pump air over said predetermined rate.

5 31. A method according to Claim 29, wherein said compensating step comprises increasing a duration over which said other pumps pump air over said predetermined duration.

10 32. A method of replenishing fluid to cells of an electric battery having a liquid electrolyte, said method comprising the steps of:  
connecting said battery to a fluid source;  
sensing when said electrolyte in said battery is low; and  
allowing fluid to flow from said fluid source to said cells through a  
conduit fixed to said battery.

15 33. A method according to Claim 32, further comprising the steps of:  
sensing when said electrolyte in said battery is adequate; and  
halting flow of said fluid to said cells.